PROCEEDINGS

OF

THE ROYAL SOCIETY.

1839. No. 38.

April 11, 1839.

The MARQUIS of NORTHAMPTON, President, in the Chair.

Lieutenant H. Alexander Ormsby, I. N., was balloted for, and duly elected into the Society.

A paper was read, entitled, "On a new equi-atomic compound of Bicyanide with Binoxide of Mercury." By James F. W. Johnston, Esq., F.R.S.

In this paper an account is given of the properties of a salt, obtained by agitating with red oxide of mercury a small proportion of hydrocyanic acid, and which the author finds to be distinguished from the bicyanide of mercury by its sparing solubility in cold water, by the strong alkaline reaction exhibited by its solution, (a property which indicates an excess of mercury,) and by its susceptibility of detonation by heat, depending on this excess being in the state of an oxide, and on the action of the oxygen on a portion of the carbon of the cyanogen it contains, and the presence of which is shown by the disengagement of hydrocyanic acid gas when acted on by hydrosulphuric and hydrochloric acids.

The analysis of this salt, given by the author, shows it to consist of

Carbon..........	5·203
Nitrogen	6·025
Oxygen	3·098
Mercury	85·674
	100.

The formula of which composition is as follows:

$$Hg.\ Cy._2. + Hg.\ O._2.$$

April 18, 1839.

JOHN WILLIAM LUBBOCK, Esq., V.P. and Treas., in the Chair.

John Thomas Graves, Esq., M.A., and the Rev. Samuel Roffey Maitland, were balloted for, and duly elected into the Society.

The ballot for James Joseph Sylvester, Esq., was postponed in consequence of the number of Fellows required by the charter not being present.

The following papers were read, viz.—

"On the Constitution of the Resins." *Part I.* By James F. W. Johnston, Esq., F.R.S.

The object of the general investigation, of which the commencement is given in this paper, is to determine the relative composition of the various resins which occur in nature, and to trace the analogies they exhibit in their constitution; and also to ascertain how far they may be regarded as being derived from one common principle, and whether they admit of being all represented by one or more general formulæ.

The chemical investigation of the resin of mastic shows that this substance consists of two resins; the one soluble, and acid; the other insoluble, and having no acid properties. The formulæ expressing the analysis of each of these are given by the author. He also shows that a series of analyses may be obtained which do not indicate the true constitution of a resin. The soluble resin, when exposed to the prolonged action of a heat exceeding 300° Fahr. is partly converted into a resin containing three, and partly into one containing five equivalent parts of oxygen, the proportion of carbon remaining constant. The same resin combines with bases, so as to form four series of salts; which, in the case of oxide of lead, consist of equivalents of resin and of oxide in the proportions, respectively, of two to one; three to two; one to one; and one to two. This soluble resin in combining with bases does not part with any of its oxygen; but if any change takes place in its constitution, it consists in the hydrogen being replaced by an equivalent proportion of a metal; and formulæ are given representing the salts of lead on this theoretical view. By boiling the resin in contact with ammonia and nitrate of silver, or perhaps with nitrate of ammonia, it is converted into a resin which forms a bisalt with oxide of silver, in which there is also an apparent replacement of hydrogen by silver.

The resin next examined is that of dragon's blood: and the conclusions deduced from its analysis are the following. First, that the lump dragon's blood is the natural and pure resin, while the strained and red varieties, being manufactured articles, are more or less decomposed: secondly, that this resin retains alcohol and ether, as most other resins do, with considerable tenacity; but that these solvents may be entirely expelled by a long-continued exposure to a temperature not higher than 200° Fahr.: and lastly, the formulæ representing its chemical composition is given.

"Researches in Embryology." —*Second Series.* By Martin Barry, M.D., F.R.S.E., Fellow of the Royal College of Physicians in Edinburgh. Communicated by P. M. Roget, M.D. Sec. R.S.

The author having, in the first series of these researches, investigated the formation of the mammiferous ovum, describes in this second series its incipient developement. The knowledge at present supposed to be possessed of the early stages in the developement of that ovum, consists chiefly of inferences from observations made on the ovum of the bird.

But there exists a period in the history of the ovum of the mammal, regarding which we have hitherto scarcely any direct or positive knowledge. It appeared, therefore, highly desirable to obtain a series of observations in continuous succession on the earliest stages of developement. In conducting this investigation, the author purposely confined his attention to a single species, namely, the rabbit, of which he examined more than a hundred individual animals. Besides ova met with in the ovary, apparently impregnated, and destined to be discharged from that organ, he has seen upwards of three hundred ova in the Fallopian tube and uterus; very few of the latter exceeding half a line in their diameter. The results of these investigations have compelled the author to express his dissent from some of the leading doctrines of embryology, which at present prevail, as respects not only the class Mammalia, but the animal kingdom at large. The following are the principal facts which the author has observed in the developement of the mammiferous ovum.

The difference between the mature and immature ovum consists in the condition of the yelk; the yelk of the mature ovum containing no oil-like globules. Both maceration and incipient absorption produce changes in the unimpregnated ovum, which in some respects resemble those referable to impregnation. During the rut, the number of Graafian vesicles appearing to become prepared for discharging their ova, exceeds the number of those which actually discharge them. Ova of the rabbit which are destined to be developed, are in most instances discharged from the ovary in the course of nine or ten hours *post coitum*; and they are all discharged about the same time.

There is no condition of the ovum uniform in all respects which can be pointed out as the particular state in which it is discharged from the ovary; but its condition is in several respects very different from that of the mature ovum *ante coitum*. Among the changes occurring in the ovum before it leaves the ovary, are the following: viz. the germinal spot, previously on the inner surface, passes to the centre of the germinal vesicle; the germinal vesicle, previously at the surface, returns to the centre of the yelk; and the membrane investing the yelk, previously extremely thin, suddenly thickens. Such changes render it highly probable that the ovary is the usual seat of impregnation. The author considers this view as being not incompatible with the doctrine that contact between the seminal fluid and the ovum is essential to impregnation, since he has found, in the course of his researches, that spermatozoa penetrate as far as to the surface of the ovary. The retinacula and tunica granulosa are the parts acted upon by the *vis a tergo*, which expels the ovum from the ovary. These parts are discharged with the ovum, render its escape gradual, probably facilitate its passage into the Fallopian tube, and appear to be the bearers of fluid for the immediate imbibition of the ovum. After the discharge of the ovum from the ovary, the ovisac is obtainable free from the vascular covering, which, together with the ovisac, had constituted the Graafian vesicle. It is the vascular covering of the ovisac which becomes the corpus luteum. Many ova, both mature and immature, disappear at this time by absorption. In some animals minute ovisacs are found in the infundibulum, the discharge of which from the ovary appears referable to the rupture of large Graafian vesicles, in the parietes or neighbourhood of which those ovisacs had been situated.

The diameter of the rabbit's ovum, when it leaves the ovary, does not generally exceed the 135th part of an inch, and in some instances it is still smaller. The ovum enters the uterus in a state very different from that in which it leaves the ovary; hence the opinion, that "in their passage through the tube the ova of Mammalia undergo scarcely any metamorphosis at all," is erroneous. Among the changes taking place in the ovum during its passage through the Fallopian tube are the following; viz. 1. An outer membrane, the chorion, becomes visible. 2. The membrane originally investing the yelk, which had suddenly thickened, disappears by liquefaction; so that the yelk is now immediately surrounded by the thick transparent membrane of the ovarian ovum. 3. In the centre of the yelk, that is, in the situation to which the germinal vesicle returned before the ovum left the ovary, there arise several very large and exceedingly transparent vesicles: these disappear, and are succeeded by a smaller and more numerous set; several sets thus successively come into view, the vesicles of each succeeding set being smaller than the last, until a mulberry-like structure has been produced, which occupies the centre of the ovum. Each of the vesicles of which the surface of the mulberry-like structure is composed contains a pellucid nucleus; and each nucleus presents a nucleolus.

In the uterus a layer of vesicles of the same kind as those of the last and smallest set here mentioned makes its appearance on the whole of the inner surface of the membrane which now invests the yelk. The mulberry-like structure then passes from the centre of the yelk to a certain part of that layer, (the vesicles of the latter coalescing with those of the former where the two sets are in contact to form a membrane,) and the interior of the mulberry-like structure is now seen to be occupied by a large vesicle containing a fluid and granules. In the centre of this vesicle is a spherical body having a granulous appearance, and containing a cavity apparently filled with a colourless and pellucid fluid. This hollow spherical body seems to be the true germ. The vesicle containing it disappears, and in its place is seen an elliptical depression filled with a pellucid fluid. In the centre of this depression is the germ, still presenting the appearance of a hollow sphere. The germ separates into a central and a peripheral portion, the central portion occupies the situation of the future brain, and soon presents a pointed process which is the rudiment of the spinal cord. These parts at first appearing granulous are subsequently found to consist of vesicles.

Thus the central portion of the nervous system is not originally a fluid contained within a tube, but developes itself in a solid form before any other part. The central portion of the nervous system sometimes attains a considerable degree of developement, although it be exceedingly minute; thus an instance has been met with in which the developement of this part had reached a stage scarcely inferior to that in another instance, in which the corresponding part measured more than ten times the length.

There does not occur in the mammiferous ovum any such phenomenon as the "splitting" of a membrane into the so-called "serous, vascular, and mucous laminæ." Rathke had already found that parts previously supposed by Baer and others to be formed by the so-called "germinal membrane," really originate independently of it: these parts are the ribs, pelvic bones, and the muscles of the thorax and abdomen, which according to Rathke arise in a part proceeding out of the "primitive trace" itself. Reichert had previously discovered that the part originating the lower jaw and hyoid bone "grows out of the primitive trace." The author beginning with an earlier period goes farther than these observers, and shows that the so-called "primitive trace" itself does not arise in the substance of a membrane, but presents a comparatively advanced stage of the object above described as the true germ. Hence the author suggests, there is no structure entitled to be denominated the "germinal membrane."

The most important of the foregoing facts respecting the developement of the mammiferous ovum, however opposed they may be to received opinions, are in accordance with, and may even explain, many observations which have been made on the developement of other animals as recorded in the delineations of preceding observers. If in the ovum of the bird the germinal vesicle in like manner returns to the centre of the yelk, the canal and cavity known to exist in the yelk of that ovum might be thus explained. The ovum may pass through at least one-and-twenty stages of developement, and contain, besides the embryo, four membranes, one of which has two laminæ, before it has itself attained the diameter of half a line, a fifth membrane having disappeared by liquefaction within the ovum.

The size of the minute ovum in the Fallopian tube and uterus affords no criterion of the degree of its developement; nor do any two parts of the minute ovum, in their developement, necessarily keep pace with one another.

The proportion of ova met with in these researches, which seemed to be abortive, has amounted to nearly one in eight. Sometimes two yelk-balls exist in the same ovum. With slight pressure, the ovum, originally globular, becomes elliptical. Its tendency to assume the latter form exists especially in the chorion, and seems to be in proportion to its size.

The author has discovered that when the germinal vesicle is first seen it is closely invested by an extremely delicate membrane. This membrane subsequently expanding is that in which the yelk is formed. He has traced the chorion from stage to stage up to the period when it becomes villous, and shows that it is not, as he formerly supposed, the thick transparent membrane itself of the ovarian ovum, but a thin envelope closely investing that membrane, and not appreciable as a distinct structure until the ovum has been crushed. When the chorion first admits of demonstration as a distinct structure the ovum consists of three membranes, a state which the author has seen in an ovum no farther advanced than about an inch into the Fallopian tube. The chorion subsequently thickens and imbibes a quantity of fluid presenting a gelatinous appearance.

April 25, 1839.

The MARQUIS of NORTHAMPTON, President, in the Chair.

Robert Rigg, Esq. and James Joseph Sylvester, Esq. were balloted for, and duly elected into the Society.

A paper was in part read, entitled, "Account of Experiments on Iron-built Ships, instituted for the purpose of discovering a Correction for the Deviation of the Compass produced by the Iron of Ships." By George Biddell Airy, Esq., M.A., F.R.S., A.R.

May 2, 1839.

The MARQUIS of NORTHAMPTON, President, in the Chair.

Arthur Farre, M.B., was balloted for, and duly elected into the Society.

A paper was in part read, entitled, "On the Motion of the Blood." By James Carson, M.D., F.R.S.

May 9, 1839.

The MARQUIS of NORTHAMPTON, President, in the Chair.

William Sharpey, M.D. and the Rev. Charles Turnor, M.A. were balloted for, and duly elected into the Society.

The reading of a paper, entitled, "On the Motion of the Blood." By James Carson, M.D., F.R.S., was resumed and concluded.

After referring to his paper contained in the Philosophical Transactions for 1820, relative to the influence of the elasticity of the lungs as a power contributing to the effectual expansion of the heart, and promoting the motion of the blood in the veins, the author states that his object in this paper is to explain more fully the mode in which these effects are produced, and to corroborate by additional facts and observations the arguments adduced in its support. He endeavours, from a review of the circumstances under which the veins are placed, to show the inconclusiveness of the objections which have been urged by various physiologists against his and the late Sir David Barry's theory of suction: namely, that the sides of a pliant vessel, when a force of suction is applied, will collapse and arrest the further transmission of fluid though that channel. The considerations which he deems adequate to give efficacy to the power of suction in the veins of a living animal are, first, the position of the veins by which, though pliant vessels, they acquire in some degree the properties of rigid tubes; secondly, the immersion of the venous blood in a medium of a specific gravity at least equal to its own; thirdly, the constant introduction of recrementitious matter into the venous system at its capillary extremities by which the volume of the venous blood is increased, and its motion urged onwards to the heart in distended vessels; and lastly, the gravity of the fluid itself, creating an outward pressure at all parts of the veins below the highest level of the venous system. The author illustrates his positions by the different quantities of blood which are found to flow from the divided vessels of an ox, according to the different modes in which the animal is slaughtered.

The reading of a paper, entitled, "Account of Experiments on Iron-built Ships, instituted for the purpose of discovering a Correction for the Deviation of the Compass produced by the Iron of the Ships." By George Biddell Airy, Esq., A.M., F.R.S., Astronomer Royal, was also resumed and concluded.

In this paper the problem of the deviation of a ship's compass, arising from the influence of the iron in the ship, more particularly in iron-built ships, is fully investigated; and the principles on which the correction for this deviation depends having been determined, practical methods for neutralizing the deviating forces are deduced and illustrated by experimental application. The author states that, for the purpose of ascertaining the laws of the deviation of the compass in the iron-built steam-ship the Rainbow, four stations were selected in that vessel, about four feet above the deck, and at these the deviations of the horizontal compasses were determined in the various positions of the ship's head. All these stations were in the vertical plane, passing through the ship's keel, three being in the after part of the ship and one near the bow. Observations were also made for determining the horizontal intensity at each of the stations. The deviations of dipping needles at three of these stations were also determined, when the plane of vibration coincided with that of the ship's keel, and also when at right angles to it.

After describing the particular method of observing rendered necessary by the nature of the vessel and the circumstances of her position, the author gives the disturbance of the horizontal compass at the four stations deduced from the observations. The most striking features in these results are, the very great apparent change in the direction of the ship's head, as indicated by the compass nearest the stern, corresponding to a small real change in one particular position, the former change being 97°, whereas the latter was only 23°, and the small amount of disturbance indicated by the compass near the bow.

After giving the observations for the determination of the influence of the ship on the horizontal intensity of a needle suspended at each of the stations, in four different positions of the ship's head, and the disturbances of the dipping needle at three of these stations, the author enters upon the theoretical investigation.

The fundamental supposition of the theory of induced magnetism, on which Mr. Airy states his calculations to rest, is, that, by the action of terrestrial magnetism, every particle of iron is converted into a magnet, whose direction is parallel to that of the dipping needle, and whose intensity is proportional to that of terrestrial magnetism, the upper end having the property of attracting the north end of the needle, and the lower end that of repelling it.

The attractive and repulsive forces of a particle on the north end of the needle, in the directions of rectangular axes towards north, towards east, and vertically downwards, and of which the compass is taken as the origin, are first determined on this supposition in terms of the co-ordinates; and thence the true disturbing forces of the particle in these directions. The disturbing forces produced by the whole of the iron of the ship are the sums of the expressions for every particle. Expressing this summation by the letter S, and transforming the rectangular into polar co-ordinates, Mr. Airy gives to the expressions for the disturbing forces the simplifications which they admit of, on the supposition that the compass is in the vertical plane passing through the ship's keel, and that the iron is symmetrically disposed on both sides of that plane. He thus deduces for the disturbing forces acting on the north or marked end of the needle,

$-\mathrm{I}\cos\delta . \mathrm{M} + \mathrm{I}\cos\delta . \mathrm{P}\cos 2\mathrm{A} + \mathrm{I}\sin\delta . \mathrm{N}\cos\mathrm{A}$, towards the magnetic north;

$\mathrm{I}\cos\delta . \mathrm{P}\sin 2\mathrm{A} + \mathrm{I}\sin\delta . \mathrm{N}\sin\mathrm{A}$, towards magnetic east;

$-\mathrm{I}\sin\delta . \mathrm{Q} + \mathrm{I}\cos\delta . \mathrm{N}\cos\mathrm{A}$, vertically downwards:

Where I represents the intensity of terrestrial magnetism; δ the dip; A the azimuth of the ship's head; and M, N, P, Q, constants depending solely on the construction of the ship, and not changing with any variations of terrestrial localities or magnetic dip or intensity.

From the consideration of these expressions for the disturbing forces is deduced the following simple rule for the correction of a compass disturbed by the induced magnetism only of the iron in a ship.

1. Determine the position of Barlow's plate with regard to the compass, which will produce the same effect as the iron in the ship.

2. Fix Barlow's plate at the distance and depression determined by the last experiment, but in the opposite azimuth.

3. Mount another mass of iron at the same level as the compass, but on the starboard or larboard side, and determine its position so

that the compass points correctly when the ship's head is N.E., S.E., S.W. or N.W.; then the compass will be correct in all positions of the ship's head, and in all magnetic latitudes.

When the disturbing iron of the ship is at the same level as the compass, the correction is stated to be much more simple, it being then only necessary to introduce a single mass of iron at the starboard or larboard side, and at the same level as the compass.

It is farther remarked that if one mass of iron is placed exactly opposite another equal mass, both in azimuth and in elevation, it doubles its disturbing effect: if one mass be placed opposite the other in azimuth, but with elevation instead of depression, or *vice versâ*, it destroys that term of the disturbance which depends on sin A, and doubles that which depends on sin 2 A: and if one mass be placed at the same level as the compass, its effects may be destroyed by placing another mass at the same level, in an azimuth differing 90° on either side. If a disturbance, from whatever cause arising, follow the law of + sin 2 A, (changing sign in the successive quadrants, and positive when the ship's head is between N. and E.), it may be destroyed by placing a mass of iron on the starboard or larboard side at the same level as the compass; if it follow the law of — sin 2 A, the mass of iron must be on the fore or aft side.

From the consideration of the expression for the disturbing forces produced by the ship, it is farther inferred, that both in the construction of the ship and in the fixing of correctors, no large mass of iron should be placed below the compass.

The expressions for the disturbing forces towards north and east, being transformed into forces towards the ship's head and towards the starboard side, give

$I \cos \delta . (-M + P) \cos A + I \sin \delta . N$, for the former, and

$I \cos \delta . (M + P)$, for the latter.

The author next proceeds to investigate the effects which result from the combination of induced magnetism with permanent magnetism. Calling H, S and V the new forces arising from the latter, and directed towards the ship's head, its starboard side, and vertically downwards, the whole disturbing force towards the ship's head becomes

$$H + I \cos \delta . (-M + P) \cos A + I \sin \delta . N;$$

and the whole disturbing force towards the starboard side,

$$S + I \cos \delta . (M + P) \sin A.$$

The manner in which the numerical values of these quantities may be found from experiment is then pointed out, and being determined from the observations on board the Rainbow, at Station I., a comparison is made between the observed disturbances of the needles, and those which would result from the action of the ship as a permanent magnet. From this comparison it appears that almost the whole disturbance is accounted for by the permanent magnetism, and that the residual part follows with sufficient approximation the law of changing signs at the successive quadrants. For the complete verification of the theory it remained only to effect an actual correction of the compass. This was done by placing below the compass, in a position determined by the previously-ascertained numerical values, a large bar magnet to neutralize the effects of the permanent magnetism of the ship, and a roll of soft iron on one side of the compass to counteract the disturbance arising from induced magnetism. That this correction was effective appears from the very small amount of uncorrected disturbance then observed in the compass.

The observations of the compasses at stations II., III., IV., are similarly discussed: the disturbing force arising from the permanent magnetism of the ship being in like manner determined, a comparison is instituted between the observed and computed disturbance of the compass; and the results of this comparison, with the exception of the observations at Station IV., are found to be in perfect accordance with the theory. Attempts are made to correct the compasses at these stations in the same manner as at Station I., but owing to the imperfection of the compasses they did not succeed so perfectly.

The observations made with the dipping needle are next discussed, and the values of the constants are deduced from them. The general agreement of those determined from the observations when the needle vibrated in the direction of the ship's keel, with those deduced from the observations when the needle vibrated transversely, is pointed out, and is considered an additional proof of the general correctness of the theory.

Observations on the disturbance of the compass in the iron-built sailing-ship Ironsides are next described. These are similar to those in the Rainbow, but not so extensive; and they are discussed on the same principles. From this discussion it is considered that the theory is in perfect accordance with the facts observed both with regard to the deviations and the intensities. The correction of one compass was effected by a tentative process, which the author considers likely to be of the highest value in the correction of the compasses of iron-ships in general. The ship's head being placed exactly north, as ascertained by a shore compass, a magnet was placed upon the beam from which the compass was suspended, with the direction of its length exactly transverse to the ship's keel: it was moved upon the beam to various distances till the compass pointed correctly, and then it was fixed. Then the ship's head was placed exactly east, and another magnet, with its length parallel to the ship's keel, was placed upon the same beam, and moved to different distances till the compass pointed correctly, and then it was fixed. The correction for induced magnetism was neglected, but there would have been no difficulty in adjusting it by the same process, placing the vessel's head in azimuth 45° or 135° or 225° or 315°.

In conclusion Mr. Airy makes the following remarks:—

The deviations of the compass at four stations in the Rainbow, and at two stations in the Ironsides, are caused by two modifications of magnetic power; the one being the independent magnetism of the ship, which retains, in all positions of the ship, the same magnitude and the same direction relatively to the ship; the other being the induced magnetism, of which the force varies in magnitude and direction when the ship's position is changed. In the instances mentioned, the effect of the former force was found greatly to exceed that of the latter.

It appears that experiments and observations similar to those applied in the above cases are sufficient to obtain with accuracy the constants on which at any one place the ship's action on the horizontal needle depends, namely

$$\frac{H}{I\cos\delta} + \tan\delta.N, \quad \frac{S}{I\cos\delta}, \quad M, \text{ and } P;$$

and that by placing a magnet so that its action shall take place in a direction opposite to that which the investigations show to be the direction of the ship's independent magnetic action, and at such a distance that its effect is equal to that of the ship's independent magnetism, and by counteracting the effect of the induced magnetism by means of the induced magnetism of another mass, according to rules which are given, the compass may be made to point exactly as if it were free from disturbance.

It appears also, that by an easy tentative method, the compass may now be corrected without the labour of any numerical investigations or any experiments except those of merely making the trials. Although the uniformity of the induced magnetism under similar circumstances is to be presumed, yet the invariability of the independent magnetism during the course of many years is by no means certain.

These statements suggest the following as rules which it is desirable to observe in the present infancy of iron-ship building. It appears desirable that

1. Every iron sea-going ship should be examined by a competent person for the accurate determination of the four constants abovementioned for each of the compasses of the ship, and a careful record of these determinations should be preserved as a magnetic register of the ship.
2. The same person should be employed to examine the vessel at different times, with the view of ascertaining whether either of the constants changes in the course of time.
3. In the case of vessels going to different magnetic latitudes, the same person should make arrangements for the examination of the compasses in other places with a view to the determination of the constant N.
4. The same person should examine and register the general construction of the ship, the position and circumstances of her building, &c., with a view to ascertain how far the values of the magnetic constants depend on these circumstances, and in particular to ascertain their connexion with the value of the prejudicial constant M.
5. The same person should see to the proper application of the correctors and the proper measures for preserving the permanency of their magnetism.

The most remarkable result in a scientific view from the experiments detailed in the present paper is, the great intensity of the permanent magnetism of the malleable iron of which the ship is composed.

May 16, 1839.

JOHN GEORGE CHILDREN, Esq., V.P., in the Chair.

A paper was read, entitled "On the visibility of certain rays beyond the ordinary red rays of the Solar Spectrum." By J. S. Cooper, Esq., in a letter to Michael Faraday, Esq., D.C.L., F.R.S., &c., &c. Communicated by Dr. Faraday.

The author states his having observed an extension of the red portion of the solar spectrum, obtained in the ordinary way, beyond the space it occupies when seen by the naked eye, by viewing it through a piece of deep blue cobalt glass. He finds that the part of the spectrum thus rendered perceptible to the right is crossed by two or more very broad lines or bands: and observes that the space occupied by the most powerful calorific rays, coincides with the situation of the red rays thus rendered visible by transmission through a blue medium. The author expresses a regret that he has not had sufficient leisure to pursue the investigation of these phænomena.

A paper was also in part read, entitled, "Fifth letter on Voltaic Combinations, with some account of the effects of a large constant Battery:" addressed to Michael Faraday, Esq., D.C.L., F.R.S., &c. By John F. Daniell, Esq., F.R.S.

The Society then adjourned over the Whitsun Recess, to meet again on the 30th instant.